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ABSTRACT

University management is examined with regard to six major areas: decision and participation, finance, information, human flows, physical plant and equipment, and academic planning. Comprehensive long and medium term planning is proposed with the special feature of decentralized decision making. The issue of information requirements for managerial decision making must be considered in view of socio-political conflicts within and outside the university. Possibilities of substantially decreasing unit costs in British universities are explored. Justification for a research collaboration among universities and its continuance into the future on a wider scale is apparent when the wider experience is considered. Latent problems of management can be discussed explicitly within and among university communities in the sense of a continuing dialogue on issues and problems. The demonstration and diffusion of promising techniques can be carried out efficiently if a clearinghouse facility is made available to which a large number of universities have access. (LBH)

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REPORT ON STUDIES IN INSTITUTIONAL MANAGEMENT IN HIGHER EDUCATION

technical report

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CO-OPERATION AND DEVELOPMENT

Centre for Educational Research
and Innovation

CERI/IM/71.47

Paris, 4th November, 1971.

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PROGRAMME ON INSTITUTIONAL MANAGEMENT IN HIGHER EDUCATION

R E P O R T

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I. Background

Can Universities be Managed? Management of a university, like any other institution, requires at least the rudiments of and applicable theory. As yet no general theory or a set of principles have been established to understand management decisions in a university. This is not surprising. Universities have become complex social organizations with many different components carrying out a wide array of functions with multiple objectives. A modern university, which is not necessarily large, usually has a wide proliferation of departments, schools, centres, all of which enjoy greater autonomy than the components of most other social organizations. The university's functions range from academic functions such research and teaching to housekeeping functions like providing residential facilities to students and maintenance of large scale plant and equipment. Nor is it easy to identify any one single objective of a university which is increasingly being called upon to meet several societal needs.

Even if the basic principles of university management were available, there may not be the required agreement upon who should manage the university. Who should make decisions about curriculum and grades, recruitment and promotion of staff, research priorities and financing? This has become a controversial matter within most universities. Consensus is difficult to obtain since (a) individuals in the academic community prefer to work autonomously and may resent any framework of management rules, (b) groups comprising the university community have conflicting views on the objectives of the institution.

Another pre-requisite for making conscious management decisions in a university is the availability of reliable and relevant information. Average and marginal cost figures of training students in different disciplines are either unavailable or are subject to wide margin of error. It is even more difficult to obtain estimates of the value of invested capital in the universities allocable to the disciplines or departments using these facilities. Furthermore, academic work itself is probably impossible to measure without resolving the fundamental questions of learning and research.

The problems of university management have been explored over the last two years in the Programme on Institutional Management in Higher Education to find ways of managing universities despite the serious difficulties. This

report provides evidence that management methods can be developed for universities to solve specific problems which they face.

Dimensions of University Management

Because of the complexity of the university it is desirable to examine universities in terms of a number of inter-related aspects. The programme identifies six major dimensions of university management and topics for investigation in each case.

(i) Decision-Participation

Decision processes: present and possible alternatives - patterns of participation - student-faculty participation and decisions under constraints - structure of governance in terms of organizational relationships - academic departmental organization - new forms of pedagogic interpersonal relations.

(ii) Finance

Budget and financial planning procedures - accounting procedures - analysis of costs and measurement of returns - study of economies of scale - development and application of such models as PPB (Planning-Programming-Budgeting) - sources of finance and cost simulation models.

(iii) Information

Classification and coding procedures of university activities - measuring and reporting of resources - tracing of information flows - setting up of networks - organization of information systems - on-line self-updating data systems - long-range information needs.

(iv) Human-Flows

The inflow, through-flow and outflow of students - enrolment projections - estimates of faculty and manpower requirements - study of input coefficients in the workload system - student-teacher ratios and their variations.

(v) Physical Plant and Equipment

The utilization of physical facilities and resources - long-range master plans - examination of the relationship between built forms and university activities - flexibility in building designs - computer-based class scheduling.

(vi) Academic Planning

Relationships between research and instruction - programmes, curricula, courses in relation to faculty and student load - inter-disciplinary activity and introduction of new disciplines - student-faculty interaction - size of classes in relation to teaching methods and subjects - cost and management interaction of the above - student and faculty effort and output.

Research results that can be relevant for university management require an orchestrated effort as attempted in this programme, to simultaneously solve a wide range of problems covering a number of dimensions. Otherwise there is no guarantee that decisions taken on the basis of partial research findings will enable the university to be steered in desired directions. For example, the development of new academic plans, without the analysis of costs in terms of personnel and facilities required has in many cases imposed excessive financial burdens on the university.

Multiple Objectives

Universities are rarely managed in terms of any given objective. Often, for historical reasons, a number of objectives have unconsciously emerged which are never explicitly stated. Nevertheless decision affecting the university are governed by such traditions, which cannot be relied upon in the contemporary context. A modern university confronts the problem of responding to a multiplicity of objectives. Three objectives usually cited, are: producing talent, conducting research and providing mass education.

First there are the management implications. Depending upon the relative priorities assigned to the different objectives, the university will need a different style and method of management.. Let us take the example of a technological university with a heavy research component. The content of courses will have certain implications on the requirements of facilities which will be distinctly different from a liberal arts university. Similarly the composition and the utilization of staff will differ. The configuration of such a technological university will require special techniques and methods of management. But the problem arises from the fact that even the technological university today is expected to provide liberal arts education as well. This requires development of a style of management which is suitable for its multiple objectives.

The current trend in university education is to take an increasing number of objectives in response to societal needs. Unfortunately, there has not been a parallel effort in the development of methods that will enable the universities to incorporate these objectives in their management process. It has not yet been possible in the programme to pursue this matter.

Second there are implications for resources requirements for meeting the current demands on universities today. It is legitimate to ask whether these demands are reconcilable with the resources likely to be made available. That such reconciliation can be brought about depends upon whether or not solutions can be found to the problem of reducing costs or increasing productivity. Is it possible to significantly reduce the unit costs of education without a resulting decline in quality? Must research be re-oriented along lines which guarantee an offsetting income to the university at the expense of losing the training value of basic research for students and professors? If savings result from the use of mass-media, is it desirable that large numbers of individuals should be taught through identical packages of pre-recorded information? However, there is no a priori reason that reduction of university costs cannot be brought about without unfavourable consequences.

A Carnegie Commission study has recently found that for colleges and universities in the United States a proportionate increase of inputs and outputs is to be expected. Research conducted in our programme, however, has provided evidence that economies are potentially possible in specific instances through better management of resources.

II. Evolution

Environmental Scanning

The period of two years is too short to expect definitive answers to the range of management issues facing universities. A long research and development cycle is needed from the time of problem identification to the general acceptability and use of the results. Nevertheless in two years it has been possible to develop and test selected methods for solving specific university problems. This required a continuing effort to scan the environment for opportunities to develop projects which could yield demonstrable results.

Initally the programme benefited from the O.E.C.D. Conference on University Planning and Management Models held in Paris on 21st - 24th April, 1969 organized by the authors of this report. Information sharing was the main purpose of the Conference where experts were invited to present six different quantitative approaches to university planning and management. The other participants included university administrators with little experience in the use of quantitative techniques. They were not convinced that the models presented were of practical value to solve the actual problem they faced. The conference highlighted the need for development projects that are directly relevant to the problems of universities. The considerable gaps between the construction of formal mathematical models on the one hand and then use in educational decision-making and planning on the other was also evident from a survey conducted by the authors as a part of the work programme of O.E.C.D.'s Directorate of Scientific Affairs. Systems models constructed for institutional managements covered the estimation of capacity, resource requirements and productivity measurement. This work was, by and large, ignored by the administrators of the institutions. This pointed to the need for the involvement of university executives in work of the kind.

An on-the-spot investigation of the university management projects in North America sponsored by the Ford Foundation revealed that such management approaches as Planning, Programming and Budgeting System required a minimum amount of information which was not readily available. As a result emphasis in the United States had to be redirected to the development of data definitions and standards for universities before constructing sophisticated models for university administration.

Each of the above experiences was helpful in shaping the programme.

Shaping the Programme

The programme was set out to develop principles and methods for improving the decision-making process and the operations of the university as a whole. The end product expected was field-tested methods for comprehensive planning in universities, integrating financial planning with facilities, faculty resources, academic programmes, etc, through an effective information system. The purpose of the programme was essentially two-fold. It should produce new models of management using modern techniques of analysis; and it should be operational, in the sense that research is to lead to direct applications locally and internationally.

It was decided at the outset that the programme was to be shaped in terms of two activities: field projects and in-house research. These activities were expected to be mutually reinforcing. Conscious of the need to develop practical methods for university managements emphasis was placed on the settleing up of research teams in the universities themselves. This was complemented by comparative research, conducted in-house by the central staff of CERI.

Field Projects

The main guidelines which governed the shape and conduct of the field projects were therefore as follows:

(a) Projects should lead to practical results;

(b) Results should be produced well before the end of 1971;

(c) Projects should have a sound theoretical basis;

(d) Individual projects should be complementary;

(e) Results should have applicability beyond the particular university or country in which they have been obtained.

(f) Projects should be carried out in close co-operation with the respective university administrations.

It should be recognized that these criteria may pull in different directions. Thus successful innovations may not always be theoretically sound; techniques suitable for one environment may not easily translate into another one; testing of new methods may take longer than the time available under the programme. The rationale for these guidelines was as follows:

(a) The requirement that projects should lead to practical results arose from the intention that the programme should be useful at the managerial level of university administration.

(b) Since the programme had to be completed by 1971, fairly detailed schedules for each project were needed. Such schedules had to spell out the stages of the project, e.g.:

(i) preliminary study;
(ii) alternative models;
(iii) data collecting;
(iv) pilot testing of conclusions;
(v) report.

(c) Since the programme was in itself a new venture, care had to be taken to avoid past mistakes. One of the main tasks of the centre was to give help and advice, and to encourage the study of models which may be new in university administration, though already tested in other areas of administration.

(d) It would have obviously been wasteful to have duplications of projects; but more important was the need for integration of the projects into a general scheme. Again, the Centre had to provide some guidance as to what was wanted; not only should proposals for projects emanate from local teams but the centre should specify gaps and find teams willing to fill them.

(e) Local conditions vary greatly and therefore projects which were accepted were biased in the direction of wider applicability, beyond the country of origin. Once more, the centre gave help whenever needed in the formulation and choice of models with this aspect in mind.

(f) To ensure that the results of the project were of practical usefulness it was necessary to bring in the university executives and the administrative staff at various stages. This enables the projects to provide live data and up-to-date information on the aspects of the university relevant to the project.

In order for all concerned to reap the full benefit of this co-operative effort, project leaders were expected to help the centre by providing answers to particular concrete questions (where the information required was available to them). In addition, it was hoped that they would be agreeable to complete any questionnaires developed as part of the programme.

In-house Research

The emperical basis for the in-house research was the data collected through the University Information Survey. This survey was launched during the Spring of 1970. A comprehensive questionnaire on student and staff numbers, academic and student loading, space, and expenditure was designed and sent to most universities in the O.E.C.D. Member Countries. Later on, a short version of this questionnaire was prepared to facilitate the responses from those universities that for various reasons found it difficult to complete the longer version.

The questionnaire was formulated essentially to test and assist in the further development of a simple analytical approach to the distribution of staff and space between and within university-type institutions and the extension of the methodology on cost evaluation model. Additionally, the data could be used for institutional self-study and comparison of one's own university position with that of the others, making due allowance for possible differences between universities.

More specifically, the questionnaire provided information for the analysis of

(a) academic and non-academic staff requirements for the university as a whole;

(b) the distribution of (a) among faculties and departments;

(c) overall area requirements;

(d) the distribution of the area requirements for different kinds of teaching rooms, laboratory and office facilities, partly based on the staff calculations from (b).

(e) costs comparisons among universities and faculties.

Literature search to find promising and testable hypotheses in the field of university management has been another facet of the in-house research. Because the paucity of literature directly concerned with the problem of university management the search was extended to other fields on the hope of gleaning useful insights. Publications concerned with business management, public bureaucracies, economics of the firm, operations research and the administrative research and development all appeared to lack the necessary

Tabulation of Information Items Sought by the Long Version of the Questionnaire

Number of corresponding question	Information Items	Components of the University				
		Total University	Administrative	Library	Each Faculty	Each Department
1.01;1.02;2.02	Organisational structure	x	x	-	x	-
	Space					
1.03	Total land area	x	-	-	-	-
1.05	Total building area	x	-	-	x	-
1.05;4.03	Laboratories	x	-	-	x	-
1.05;4.03	Lecture rooms	x	-	-	x	-
1.05;4.03	Seminar/tutorial rooms	x	-	-	x	-
1.05;4.03	Academic staff offices	x	-	-	x	-
1.05	Student residential accomodation	x	-	-	-	-
1.05;4.03	Administrative staff offices	x	-	-	x	-
1.05	Staff and student recreation facilities	x	-	-	-	-
3.02	Library floor area	-	-	x	-	-
3.04	Number of readers places available	-	-	x	-	-
	Personnal					
1.13;4.06;4.11	Academic staff	x	-	-	x	x
2.03;4.06;4.11	Administrative staff	x	x	-	x	x
3.05	Library staff		-	x	-	-
1.13;4.06;4.11	Technicians and others	x	-	-	x	x
	Students					
1.09;4.05;4.11	Total enrolment	x	-	-	x	x
	First degree	x	-	-	x	x
	Higher degree	x	-	-	x	x
	Including course work by research only	x	-	-	x	x
1.08;4.10	Short specialized courses	x	-	-	x	-
1.10	In residential accomodation	x	-	-	-	-
	Academic Programme					
	Average weekly scheduled staff hours given					
4.11	First degree	-	-	-	-	x
4.11	Higher degree	-	-	-	-	x
	Including course work by research only	-	-	-	-	x
	Average weekly scheduled student hours received					
4.11	First degree	-	-	-	-	x
4.11	Higher degree	-	-	-	-	x
1.07;4.04;4.11	Number of programmes of study	x	-	-	x	x
1.14	Service teaching	-	-	-	x	-
1.15	Sandwich courses	x	-	-	-	-
	Expenditures					
1.19;2.02;3.05	Gross remuneration for all employees	x	-	-	-	-
1.13;4.06;4.11	Gross remuneration for individual staff members	x	x	x	x	x
1.19;2.04;3.07; 4.11	Total annual recurrent expenditure	x	x	x	-	x
1.20;2.05;3.08; 4.11	Non-recurrent major capital expenditure	x	x	x	-	x
1.21	Non-recurrent on buildings only	x	-	-	-	-
3.07	Total annual expenditure for book purchase	-	-	x	-	-
	Total annual expenditure for book-binding and repairing	-	-	x	-	-
	Total annual expenditure for periodicals	-	-	x	-	-

(x) Information sought.

(-) Information not sought.

relevance to the crucial aspects of universities. The ERIC (Educational Research Information Centre) documents available in microfiche at CERI were only occasionally used since its coverage of institutional management was quite limited.

Inter-Project Co-Operation and Communication

Frequent meetings of project leaders were held to encourage inter-project co-operation. These meetings were as follows:

First Meeting was held at The Institute of Mathematical Statistics and Operations Research, Technical University of Denmark, Lyngby, Denmark, 5th-6th November, 1969.

Second Meeting was held at the University of Bradford, Bradford, United Kingdom, 18th-19th June, 1970.

Third Meeting was held at the Chalmers University of Technology, Gothenburg, Sweden, 11th-12th January, 1971.

Final Meeting was held at the O.E.C.D., Paris, 23rd April, 1971.

These Meetings represent mile-stones in the evolution of the programme. At the Lyngby Meeting the participants presented their proposed work-plans for constructive comment. The CERI staff, in particular, received important suggestions on its survey design from the project leaders. At the Bradford Meeting it was possible to review the progress of the projects under way. Proposals for additional projects were also considered. The Gothenburg Meeting served a dual purpose. First, the project leaders of the advanced projects discussed the final phases of their work while the new comers were able to present their work plans. Second, the Vice Chancellors and rectors of the universities participating in the programme participated in the deliberations. They constituted themselves into a Steering Committee to advise the CERI staff on the planning of the forthcoming conference at which the results of the programme were to be presented and evaluated. The Final Meeting of the project leaders, held in Paris, discussed their presentations at the Evaluation Conference scheduled to be held on 2nd-5th November, 1971.

To strengthen the statistical basis of the activities of the programme and to review the state of the art a Meeting of experts on statistics of University Education was held in Paris on 15th-16th October, 1970. Heads of national offices of educational statistics, presented the most recent developments in their countries. (Netherlands, United Kingdom, Sweden, United States,

Federal Republic of Germany as well as the American Council of Education in Washington D.C.). Project leaders also participated and challenged the relevance of national statistics for management problems of individual institutions.

By far the most important turning point in the evolution of the programme has been the success of a conspiracy to get the direct involvement of the Rectors (now called Presidents in France) and Vice Chancellors of the universities that had set up the experimental projects under the programme. It is true that in many cases the university executives had got involved in the work of the teams in their own university. But interaction among themselves as a group and the interaction of this group with the project leaders was brought about only after the organization of the Steering Committee in January 1971. This created the awareness of the programme by the top management of universities and their direct participation in the steering of the programme. In particular, the Steering Committee has guided the CERI secretariat to plan the Evaluation Conference where the results of the programme were to be discussed by the executives and other representatives from universities as well as government officials.

From the foregoing factual description it should not be construed that the various stages of the programmes evolution were largely pre-determined. In fact, the opposite was the case since unforseen events constantly brought about changes and revisions. One field project had to be abandoned because qualified staff could not be mobilized. Ambitious plans for the construction of a generalized model of university operations was never implemented because of doubts concerning the practical usefulness of such work. In another case the previous development of the programme enabled the formulation of a study on programme budgeting directed to post-graduate education and research.

Two reasons can be given for not adopting a precise and detailed research design for the programme at the very outset. In the first place, as has already been pointed out, even a rudimentary theoretical framework for studies in university management was not available. This made it impossible to construct a sufficiently definitive research design a priori,

and approaches had to be improvised taking advantage of opportunities for fruitful directions of work as and when they occurred.

Secondly the intrinsic nature of action-research which characterized the programme, is to take advantage of feedback at each phase of experimentation. In place of testing well-formulated hypotheses regarding the behavioural elements of a university, the focus of the work was on improving the efficiency of its operations through a continuous assessment and revision of the approach. Until such time as a well-founded theory and concepts are developed the research strategy will have to be of this evolutionary nature.

III. Institutional Self-Studies

Experimental Projects

Eight universities were brought together to set up teams within their institutions to work on their respective pre-selected problem areas. These teams have worked over varying lengths of time, none of which exceeded two years. By concentrating the effort in selected university environments the approaches developed may not have the attraction of generality, but this has been more than offset by the demonstration of concrete ways of tackling specific management problems. Even so, it is necessary to stress the experimental nature of the projects.

The table below gives a brief description of each project as it stood at the time of its inception.

PROJECT LOCATION AND LEADER	PROJECT DESCRIPTION
University of Copenhagen, Denmark (*) Professor A. Jensen	Teaching, research and thesis-advising load on faculty members; budget process; criteria for initiating or dropping a subject or curriculum; definition of output of faculty. The foregoing will contribute to the study of methods of short-term and long-term planning.
Technical University of Gothenburg, Sweden Mr. C.G. Appelquist	Development of a Programme Budgeting System for a Swedish technical university (Gothenburg). Development of an output-oriented finance methodology applicable to the centralized Swedish system.
University of Nijmegen, The Netherlands Mr. J.L.M. Goossens	Construction of models relating educational programmes, research programmes and student numbers to personnel and space requirements.
University of Lancaster, United Kingdom Professor M. Simpson	Academic and physical planning in relation to cost constraints. Investigation of step functions in costs and the reactions of planning bodies to cost and constraints information
University of Bradford, United Kingdom Professor J.A. Bottomley	Analysis of costs of "producing" graduates in various disciplines. Calculation of marginal cost per student in various subject fields to aid expansion decisions. Construction of models to forecast cost variations in relation to changes in student numbers, teaching methods, residence patterns, etc.

(*) The Copenhagen University Project was carried out by the team from The Technical University of Denmark.

Table (Continued)

PROJECT LOCATION AND LEADER	PROJECT DESCRIPTION
Universite de Paris - Ouest, Nanterre, France Professor G. Terny	The feasibility of setting up a Diplôme d'Etudes Superieures programme in economics. To arrive at a programme commonly agreed upon by students, academic staff and industry; to analyse the decision-making process within the department in establishing the programme as well as to evaluate the resource requirement in terms of staff, facilities and financial costs
The Free University of Berlin, Federal Republic of Germany Mr. T. Klose	Information needs for long-rance planning of personnel and physical facilities in terms of the new departmental organization of the university. The information system to be available to staff and students for exercising decision-making in the various university bodies and for the university president for assigning personnel in terms of qualifications and job requirements.
The University of Novi Sad, Yugoslavia Professor S. Han	To design an information system for making normative forecasts of the student flows and choice of subject within the university. To examine the entrance criteria for students with different socio-economic and regional backgrounds and the type of graduates to be "produced" in terms of national/regional needs.

The last three projects were designed later in the programme and, as a result, their work is still of an interim nature.

The experimental nature of the projects enabled them to be constantly revised in terms of their organization, content and direction. The composition of the teams, also varied. As a result it is not easy to estimate the magnitude of the total effort involved in this entire net work of the projects. The table below shows an estimate of personnel and financial resources committed to the projects. The financial estimates shown here may not necessary conform to formal audited figures.

Estimate of the Magnitude of Effort in the Field Activities of the Programme on Institutional Management in Higher Education as of February 1971.

Field Activities		Prof. Resource Persons.			Budgeted Costs (In French Francs)		
		Number	Full-Time Equiv.	Total	Local Contribution	CERI Contribution	% CERI/Total
Total for all Projects		52	34.46	2,021,937	1,313,390	408,546	20.20%
On-going Projects	Bradford (U.K.)	7	6.1	215,679	132,367	83,312(1)	38.6%
	Lancaster (U.K.)	7	3.4	216,612	133,300	83,312(1)	38.5%
	Copenhagen (Denmark)	7	3.5(2)	366,795	283,432(3)	83,362	22.7%
	Nijmegen (Nether.)	7(4)	4.3(5)	249.930(6)	166,620	83,310	33.3%
	Chalmers (Sweden)(15)	7	5.5	384,300	343,050	41,250	10,7%
New Projects	Novi Sad (Yugoslav.)	4(7)	3.0(7)	91,700	77,700(8)	14,000(9)	15.3%
	Nanterre (France)	6(10)	3.0	200,000	180,000(11)	20,000	10.0%
	Free University of Berlin (Germany) (4)	7(12)	5.66	296.921	296.921	0	0%

Explanatory Note: The figures shown above cover the period 1st January 1970 - 1st July 1971 for On-Going Projects, and 1st January 1971 - 1st January 1972 for New Projects. Unless otherwise indicated in the footnotes, the figures in the column labelled "CERI Contributions" exclude travel and reproduction costs assumed by the Centre. Similarly, the National Contribution figures exclude certain overhead costs (e.g. space) contributed by the Universities in which the projects are located. In general, each project also meets additional (non-budgeted) costs (e.g. computer use, additional resource persons) not indicated in the table above.

Amounts have been converted to French Francs using the table of "Exchange Rates at Par Value" appearing in the O.E.C.D. publication Principaux Indicateurs Economiques. December 1969.

(1) The CERI contribution of £12,500 is divided equally between the two projects.

(2) Includes one person full-time for six months, one person full-time for two months, plus the project leader (estimated one-fifth time).

(3) Includes contribution from Shell-Denmark (112,500 d. kr.).

(4) The budget lists a sociologist, economist, system's analyst, programming and data-processing assistants plus research associates. The number of research associates is estimated to be two, in the absence of any other additional information. The project leader has been added to arrive at a total of 7.

(5) The research associates are estimated to contribute 0.5 F.T.E. based on budgeted salary figures. The project leader is assumed to contribute 0.3 F.T.E. in the absence of additional information.

(6) The project leader's salary has not been included in this budget.

(7) This figure does not include the professional resource persons who will be employed under contract for the project nor CERI experts.

(8) The sum of 350,000 n. dinars, approved by the Council for Scientific Work of the Region Voivodina, has been granted to cover the costs of the current project plus certain extensions. It has been estimated that one-half of this amount will be used to support the project.

(9) This sum represents the salary of one O.E.C.D. expert for a period of two months attached to the project.

(10) This figure does not include professional resource persons who will carry out a survey of industrial firms under contract.

(11) This figure includes contribution of Shell-France.

(12) Based on four full-time persons plus an estimated three persons part-time.

(13) Provisional.

(14) Subject to governmental approval.

(15) During 1970, the Chalmers University of Technology Project was an "Associate" project, with no CERI contribution. Subject to governmental approval, this project will become a full participant in the Programme, beginning 1st March through an additional grant of $15,320 jointly financed by CERI ($7,500) and the Swedish Government ($7,820). This grant will provide for expanding the project team to carry out complementary work during a 6-month period. The figures shown include this additional contribution which amounts to 3 professional resource persons (2 F.T.E.). The resource persons and budgeted costs have been arrived at by adding this additional contribution to an estimate of the resources for the period 1st January, 1970 - 1st July, 1971. The estimates were provided by Mr. Appelquist.

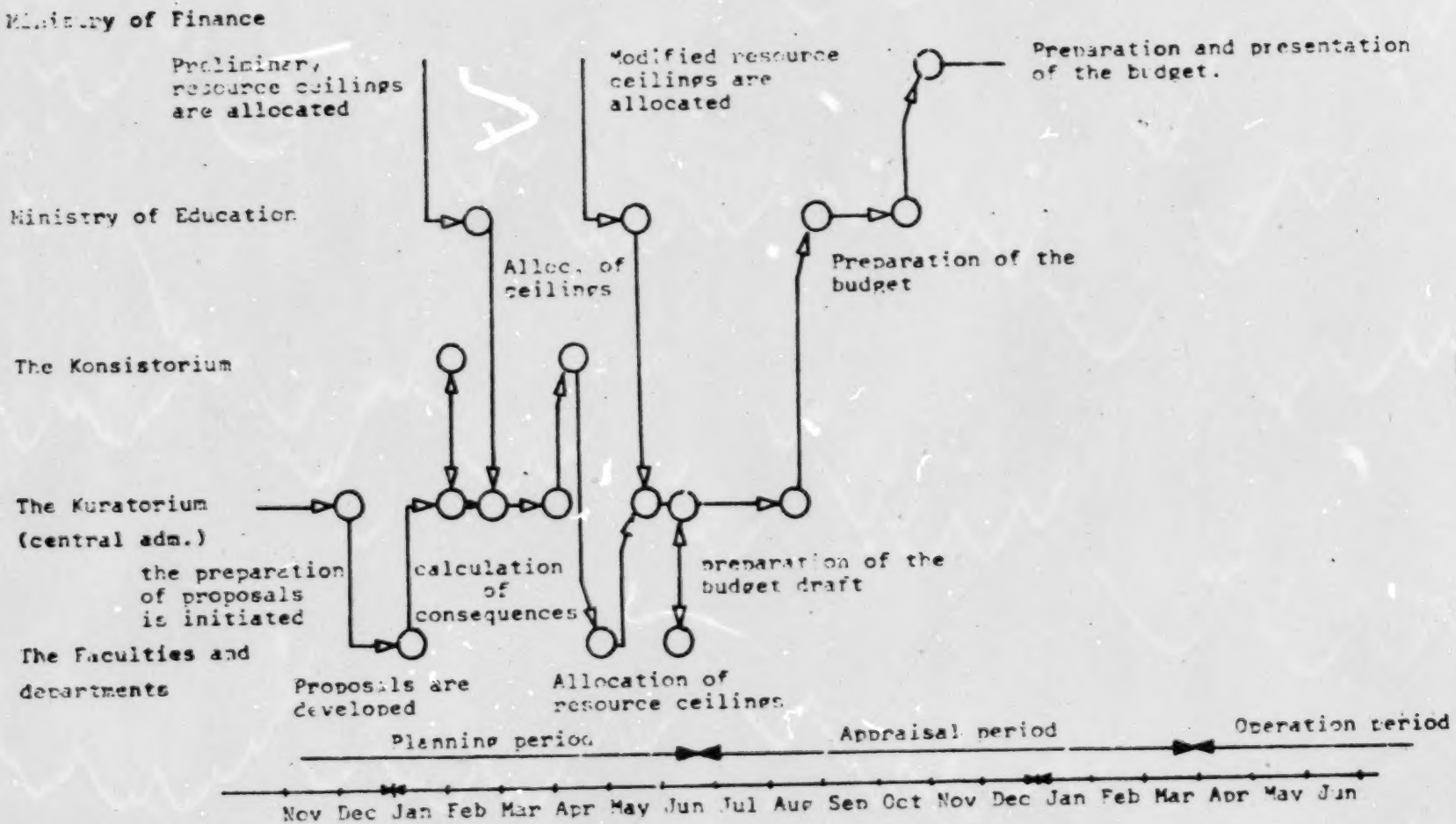
Findings

In this section we will give an inventory of the findings of each of the experimental projects without claiming to be exhaustive. The list is illustrative only. The reader is encouraged to browse in the rich pasture offered by the publications of the project reports.

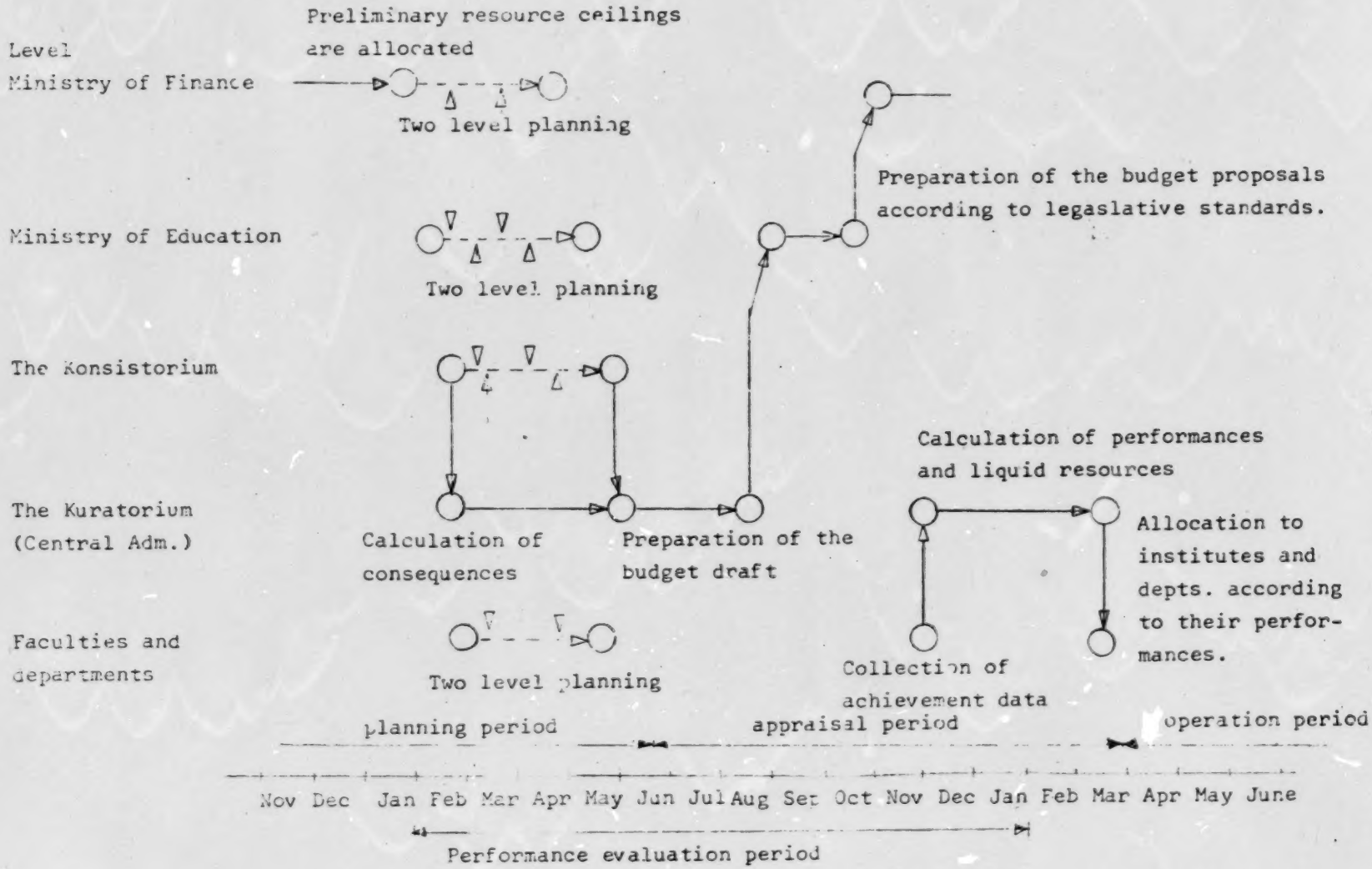
The Danish team found that for the University of Copenhagen as a whole the number of students per full-time teacher in 1970 was about the same as in 1955. But the student/teacher ratio in the Humanities faculties is found to be higher than in other faculties. With the relatively greater increase in the enrolment in the Humanities faculties the student/teacher ratio must have fallen in these faculties. Otherwise the overall student/teacher ratio in the university would have increased. Nevertheless, the trend toward smaller class sizes (seminars) has increased the demand for teaching which has resulted in heavier teaching loads. This is one source of the discontentment felt among the students as well as the staff. However the faculty of Natural Sciences acting on its own and without an overall university plan seems to have solved the problem by hiring increasing numbers of non-tenured teachers to allocate teaching loads. This was done because of central restriction on the creation of tenured posts.

As for the budgeting and planning of the higher educational institutions by the government, excessive centralization was found to be the root cause of major decision lags and dysfunctionalities in the university operations. The two following charts describe the actual and the desired information flows connecting decision points phrased over-time.

Actual Information Flows - Decision Points for University Budgeting in Denmark


Ministry of Finance
Preliminary resource ceilings are allocated
Modified resource ceilings are allocated
Preparation and presentation of the budget.
Ministry of Education
Alloc. of ceilings
Preparation of the budget
The Konsistorium
The Kuratorium (central adm.)
the preparation of proposals is initiated
calculation of consequences
preparation of the budget draft
The Faculties and departments
Proposals are developed
Allocation of resource ceilings
Planning period
Appraisal period
Operation period
Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun

Desired Information Flows and Decision Points for University Budgeting in Denmark


Level
Preliminary resource ceilings are allocated
Ministry of Finance
Two level planning
Preparation of the budget proposals according to legaslative standards.
Ministry of Education
Two level planning
The Konsistorium
The Kuratorium (Central Adm.)
Calculation of consequences
Preparation of the budget draft
Calculation of performances and liquid resources
Allocation to institutes and depts. according to their performances.
Faculties and departments
Two level planning
Collection of achievement data
planning period
appraisal period
operation period
Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May June
Performance evaluation period

The third major achievement of the Danish project has been the development of a dual analytical procedure using simulation of student and teacher flows as a basis for solving a two-level optimization problem of the university. The two levels postulated are the university Senate and the departments comprising the university.

The inputs to the model are the future expected teaching demands for each of the sectors, the future expected total resource quotas or ceilings available to the university and finally the current (initial) distribution of tenure and non-tenure teachers. These are presumably provided from the simulation. The model then works out for each planning period, the allocations of tenure and non-tenure positions, that best satisfy the overall teaching demands, considering that the cost and productivity per tenure and non-tenure position varies from one faculty to another, as well as different possibilities of substitution between tenure and non-tenure teaching which the faculty of natural sciences has actually done without using this optimization procedure.

These differences are mainly a result of the different research and teaching policies and goals, adopted by the faculties of the universities. Each time resource ceilings are changed, it is possible to calculate a new resource allocation pattern for the entire planning horizon. Also changes in the demands for teaching can be introduced to find out the resource implications.

The model can finally be used to evaluate how the resource allocations are affected if one sector wants to introduce an innovation, which will affect its unit cost or its productivity in terms manpower inputs.

The Nijmegen team distinguishes fixed-time activities (teaching) from non-fixed time activities (research supervision) and then goes on to estimate in great detail how each staff member spends his time in a number of activities comprising a programme. Using the department of psychology as a test case, it was found that 93 per cent of the staff time on an average can be attributed to student-related activities. This provided the rationale for using the student flow model to estimate the requirements of teaching man hours. The team then go on to show how step by step it is possible to work out the costs in order to come up with the total budget for current expenditures.

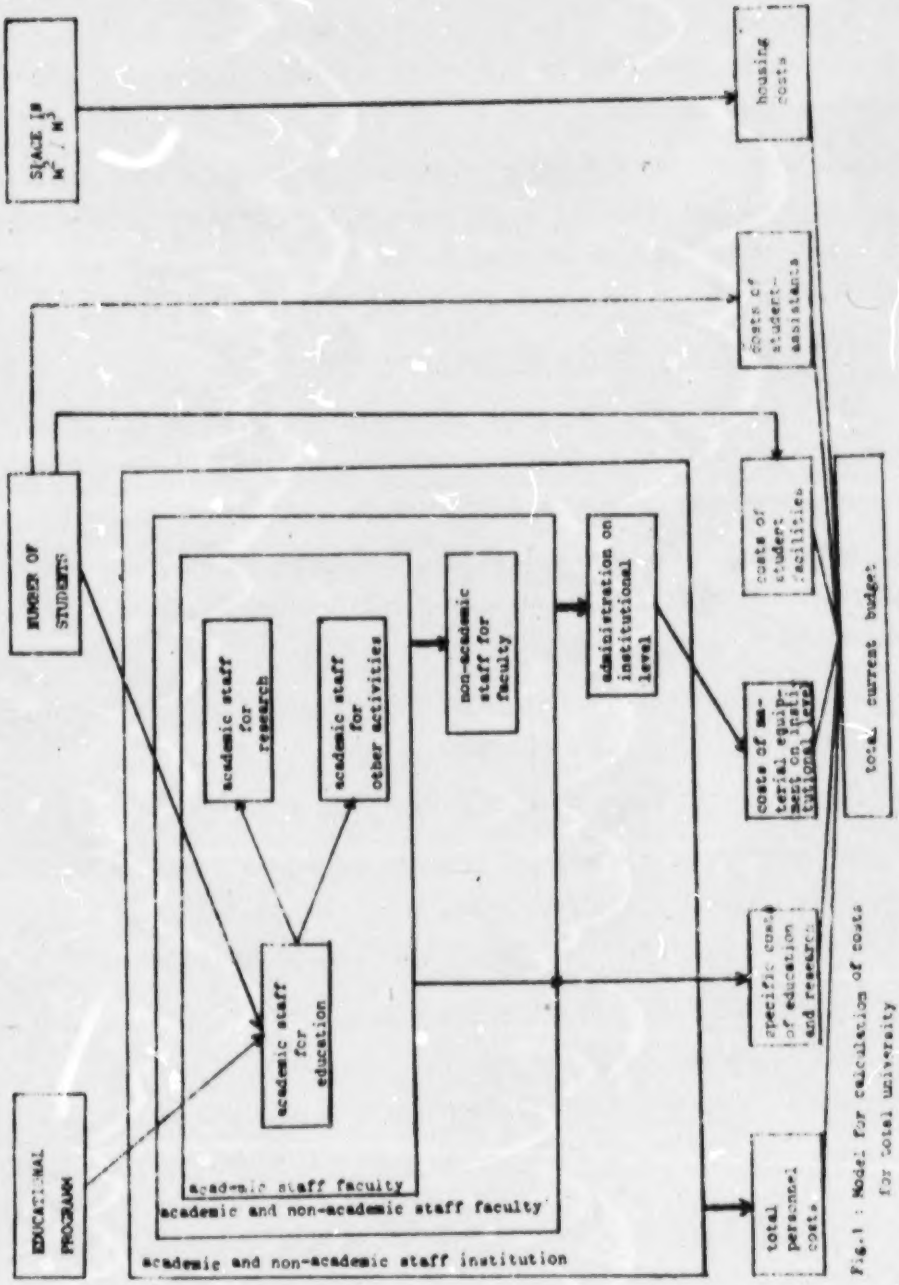

SPACE IN m² / m³
housing costs
costs of student-assistants
NUMBER OF STUDENTS
costs of student facilities
administration on institutional level
academic staff for research
academic staff for other activities
non-academic staff for faculty
costs of material equipment on institutional level
total current budget
academic staff for education
specific costs of education and research
EDUCATIONAL PROGRAM
academic staff faculty
academic and non-academic staff faculty
academic and non-academic staff institution
total personnel costs

Fig.1 : Model for calculation of costs for total university

More significant, however, is their conclusion, after a self-evaluation of the model constructed by themselves, that the fundamental aspects of education and research and their mutual interaction are still beyond their reach. They propose next to use systems theory to describe and analyse this interaction process.

The work of the Lancaster team can best be described in terms of the eight inter-related projects whose results were finally merged into an overall university - wide development plan to assist the quinquennial planning process. The specific projects have been described by the team leader.

(1) Department Models of Teaching Loads

The study of nine Departments within the University, in which detailed surveys were made of the effect on teaching loads of different course structures, and student numbers..

The use of these studies within some Departments, and the formulation of general hypotheses for University planning purposes - in terms of staff and student numbers.

And some special problems - for example the special teaching loads experienced in newly established Departments.

(2) General Growth Pattern During 1972-77

The problem of how best to move in aggregate, from the size expected in 1972 to that planned for 1977, taking into account balances in student population and intake rates, and other (financial) constraints.

(3) Student Course Preferences

Studies on the choice of supplementary courses, and switches in 'major course' intentions, for which substantial scope exists within our degree structure. The effect of such switches on the general planning process; and the ways in which they might be altered by changes in the control processes allocating staff increases to Departments, and by the setting up of new Departments and courses.

And the interaction between this and the conclusions of II (1) and II (2) above in terms of staff requirements.

(4) Allocation of Funds to Library

Studies of the ways in which funds would be dispersed, in order to provide given levels of library service. The derivation of 'book stock increase' likely to arise from given levels of funding, with particular reference to the (particularly high) inflationary tendencies in book and serial prices. The interpretation of proposals for total library budgets into alternative forms for decision-making purposes.

(5) Academic Staff Costs

The effect on average University staff costs of a substantial expansion in staff numbers, through the estimation of staff resignations, promotions and appointments and average salary levels appropriate to each.

(6) Virement

An exploration of possible forms of virement, allowing Departments more internal control of their total allocation of resources; and ways in which such procedures could be extended to encourage department 'academic preferences' to affect the development of ancillary common services - such as computing, technical teaching aids.

(7) Administrative Services

A study to determine appropriate ways of setting levels of secretarial and administrative staff within Departments - their relation to numbers and seniority of academic and other staff.

(8) Flexibility in Building Design

A study on a major new 'arts' teaching building for a nominated group of Departments; the resolution of the conflict between having 'custom-built' accommodation for each of the Departments, and the inherent uncertainty in the rate of growth initially planned for each.

The Nanterre team, recently installed, has already found after, the opinion survey of 314 university students of the 4th year in Economics, that the licence (first degree) was sufficient to enter the higher degree programme. But 93 per cent of the students did not consider this licence as adequate for the profession of their choice. The reasons given were that their studies were not sufficiently specialized, had little application value and were not co-ordinated to effect a smooth transition to professional life.

One reason for entering the higher programme rather than the labour market seems to be their fear of competition in the professions for which they felt inadequately prepared. The student body was equally divided as regards the orientation of the DES programme - half of them stressing the professional interest while the other half desiring to pursue pure and applied economic research. Should we therefore have two distinct graduate programmes satisfying these different needs? This according to the students, implied that the academic organization in terms of examinations, class sizes and forms of teaching, etc., should also be different in accordance with the two types of preferred courses.

The team of the Chalmers University of Technology at Gothenburg has just started to install a planning programme budgeting system for undergraduate education and to extend this to graduate education and research. Many doubts have been recently raised concerning the use of programme budgeting framework itself. But the Chambers endeavour by the university administration to explore applicability of the PPBS by going to the grass roots may produce evidence of its usefulness.

The Novi-Sad team has begun to examine the inflow, throughflow and outflow of students at the university. Detailed examination is being made of subject choices by the students, their transfer propensities and their success rates. Regional and socio-economic backgrounds of students are considered as factors determining the transition and transfer coefficients linking the departments/faculties and levels of study at the university.

The inquiry covering 1200 secondary school leavers in the autonomous region of Voivodina showed that 80 per cent of high school students planned to continue their education at the university. Interest in studying law, social sciences, natural sciences and medicine was far greater then agronomy, economics, engineering and technology. The training in the latter subject fields, however, was more meaningful in view of the economic structure of the region in which university was located.

Finally, a special study of the student flows in the faculty of economics may reveal some of the factors responsible for the large number of leavers after the first and second year of study.

The Free University of Berlin team is not formally linked to the programme but its work will form a part of the total picture. Despite the social stress and perhaps because of the reforms, the team has carefully undertaken the task of building an information system covering plant and equipment, space and then moving to students and personnel. The use of capacity models is being explored.

The Bradford team found it difficult to effect economies in the cost per student year with present levels of enrolment without adversely affecting the quality of education. But there do seem to be considerable economies of scale arising from increased enrolment.

Savings in teaching costs are expected to arise from the fact that lectures in which student-teacher exchange is not required can expand to unlimited numbers without affecting the quality of instruction. They will also occur in connection with a filling-up to capacity of laboratory classes and the like.

There appears to have been considerable over-building in the British university system and more students can be enrolled without increasing space requirements.

Even if this were not the case, using buildings and equipment outside the normal thirty-two hour teaching week of a thirty-three week teaching year would bring further substantial economies.

The result of the examination of these potential economies revealed the possibility of a doubling of enrolment with about seventy per cent of addition funds without altering current practices, course structures, or the quality of education.

Further substantial economies would be available from two intakes per year using buildings throughout a forty-eight week/year.

Checks of existing economies of scale within the University of Bradford and of departmental plans for growth with associated cost structures confirms this. Marginal costs can be and should be a function of existing average costs per student year.

IV. Comparative Studies

The University Information Survey enabled the centre to pursue three comparative studies in university costs and resource utilization.

1. An analytical approach to the estimation of a university's total staff and facilities requirements and their distribution among university components. A supplementary model for determining departmental requirements. This study was carried out by Professor Keith Legg.

2. Comparative cost studies for selected universities at aggregated level as well as at faculty level. These studies were carried out by Vice-Chancellor, C.F. Carter.

3. The Secretariat carried out comparative studies of student/staff ratios, academic loading and expenditure on departmental level.

1. The first study developed two models.

1.a. Total University Staff and Facilities Requirements and their Distribution

This overall university model develops a series of relationships, expressed algebraically, between the component elements of the university. Its essential purpose is to aid in resource allocation within and between universities. Values of parameters, necessary for model solutions, are available from the University Information Survey.

A simple explanation of the methodology is set out in Diagram I.

It commences at the departmental level where input data on student enrolment, classified into 1st degree and higher degree, is required. Each department is classified into one of ten broad subject fields. At this point academic staff requirements for each department can be defined. Academic staff numbers determine supporting staff requirements (technical, administrative, etc.), and annual recurrent expenditure at the departmental level.

To procede from this stage to the overall university it is necessary to make several assumptions. The simplest set, utilized here, is that all students and academic staff are attached to a particular department. In a specific context different assumptions re the relationship of departmental

Methodology for Determining Resource Needs for Overall University

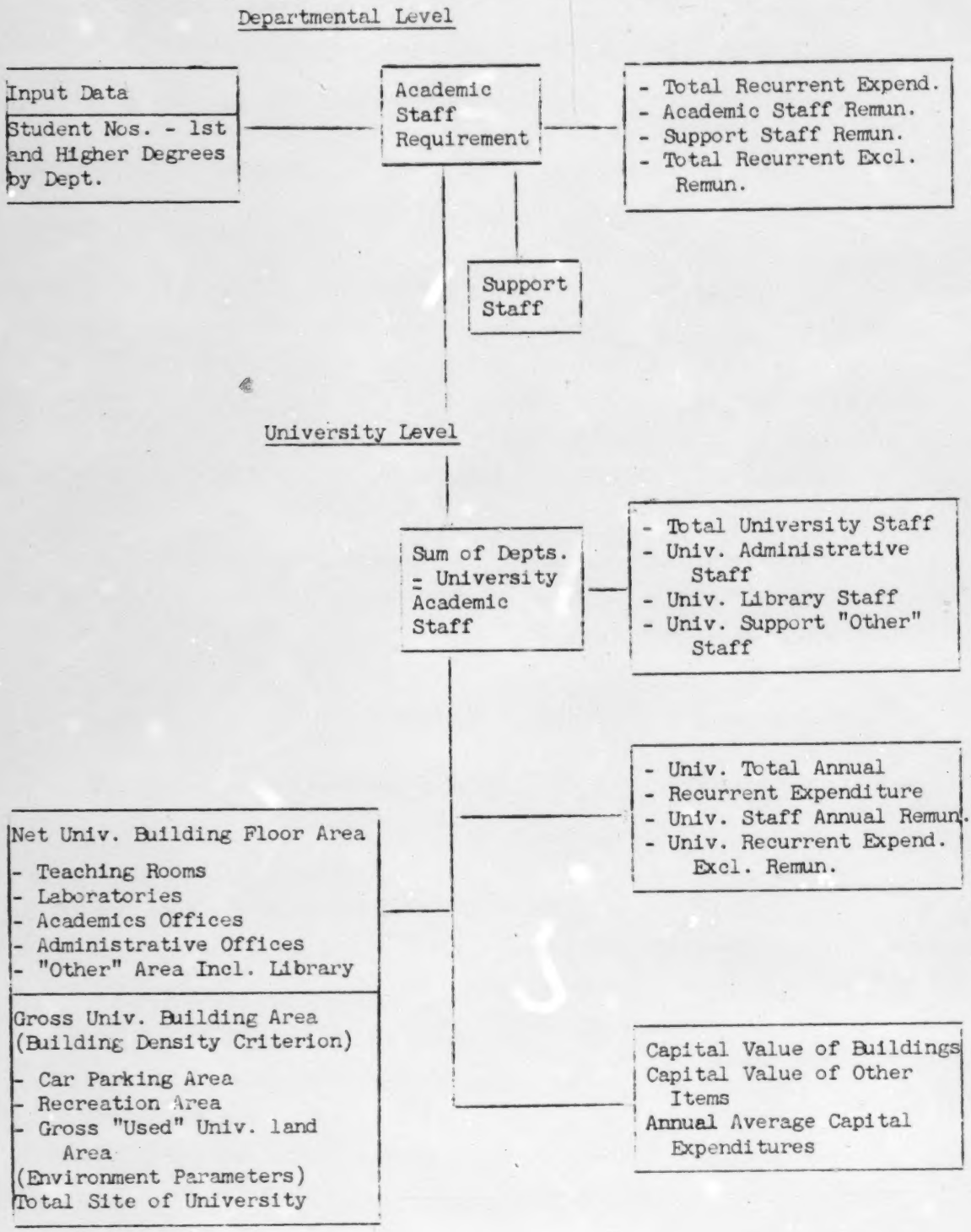

Departmental Level
Input Data
Student Nos. - 1st and Higher Degrees by Dept.
Academic Staff Requirement
- Total Recurrent Expend.
- Academic Staff Remun.
- Support Staff Remun.
- Total Recurrent Excl. Remun.
Support Staff
University Level
Sum of Depts. = University Academic Staff
- Total University Staff
- Univ. Administrative Staff
- Univ. Library Staff
- Univ. Support "Other" Staff
- Univ. Total Annual Recurrent Expenditure
- Univ. Staff Annual Remun.
- Univ. Recurrent Expend. Excl. Remun.
Net Univ. Building Floor Area
- Teaching Rooms
- Laboratories
- Academics Offices
- Administrative Offices
- "Other" Area Incl. Library
Gross Univ. Building Area (Building Density Criterion)
- Car Parking Area
- Recreation Area
- Gross "Used" Univ. land Area
(Environment Parameters)
Total Site of University
Capital Value of Buildings
Capital Value of Other Items
Annual Average Capital Expenditures

DIAGRAM I.

students and staff and overall university numbers may be more appropriate. These can be incorporated without undue difficulty under the present assumption the sum of departmental students and academic staff equal the corresponding university figures.

Relationships can now be developed at the university level. Administrative, library, technical and other staff are expressed in terms of total academic staff. Simple algebraic substitutions enable university annual recurrent expenditure, and its components, to be expressed similarly.

University space requirements are categorized into various groups according to function. These are, broadly, net university building floor area, gross university building area, recreational facilities, and car parks. The first category is further sub-divided into teaching rooms, laboratories, academic and administrative staff offices, library and "other" areas. Each of these components is evaluated independently and all are reducable to expressions in which academic staff is the only independent factor.

University used land area is the sum of gross building area, recreational and car park areas. In order to assess the total site requirement from this, building density and 'environmental desirability' factors are introduced.

To convert these capital requirements into monetary terms, it is necessary to know the cost per square unit of the different types of provisions. If growth is envisaged, the percentage growth rate of the student populated must.

The crucial element in the practical application of this methodology is a knowledge of the parameter values with the algebraic functions. Approximate values for these parameters were obtained from 15-university sample, and from the 80-university survey.

1.b. Departmental Requirements of Staff and Space

This provides a complete methodology for determining departmental resource needs where the department is responsible for a whole range of different courses of study, where its staff teach in other departments, and where it turn benefits from staff external to the department.

The basis of this methodology is the generalized "programme of study" concept. A "programme of study" is those requirements which must be satisfied in order to qualify for a degree or diploma. From this concept is derived a general equation applicable to any course of study run by a department. This might be an undergraduate degree course post-diploma research studies, short courses, etc. The departments student enrolment is classified into three groups - fundamental, advanced and higher.

From these categories it is possible to compare different programmes of study from different educational systems far more directly than with the simpler "1st degree/higher degree classification of the overall model. Each department can categorize its programmes of study more finely, and the requirements for different levels of students can be more exactly weighted.

A programme of study under the auspices of one department, may be taught by academic staff attached to both that department and other departments. This service-teaching between departments is explicitly incorporated in the analysis by means of distribution factors. Thus the contribution by academic staff of any particular department to various programmes of study in accounted for in determining the departmental staff needs.

Given the data on different levels of students, and the detailed structure of teaching of each programme of study, it is hence possible to obtain a more accurate assessment of the absolute academic staff requirements of any particular department. In addition a means of assessing the composition of this in terms of part-time and full-time staff is included.

Technical and other support staff (excluding administration) is postulated as a function of departmental support area, including laboratories and other working space necessary for the adequate functionning of the department. Although technical support staff is also related to academic staff, data from the 80-university survey suggests that this relationship is small. The method also enables, as a by-product, the assessment of departmental support area requirements.

Departmental administrative staff is related to total departmental academic and technical staff. Furthermore it is a reasonable assumption that the degree of administrative servicing is related to the level of responsibility of these other staff. Hence administrative staff are a function of departmental staff, weighted for differing levels of responsibility.

The framework of the departmental model is illustrated in diagram II.

In addition to providing insight for analytical investigation for the models, findings from the data analysis provided information useful inits own right.

The application of such management aids as these models would dearly be much simpler with completer facilities, due to the large quantity of data and calculation involved. In any case the compilation of such information is required for effective running of a university. Although it is an administrative task to set up the process, it is essential to involve academic staff at all levels and at all stages. This is particularly important in assessing the inputs of data.

The total methodology serves as an aid in the decision-making process, by providing information and assessment of resource needs. It is not a substitute for the policy-making process itself.

2. The second study concentrated on tracing inter-faculty and inter-country effects on the:

   (i) average cost/academic staff
   (ii) average cost/student enrolled
   (iii) student/staff ratio.

The model used assumes constant proportional cost differences between any two given faculties for all countries and similar for any two countries for a given faculty.

The analyses under points (i) and (ii) above suggest that the country effect is more important than the faculty effect. This conclusion is confirmed by the fact that the range of the variations in the estimated country parameter is much larger than that of the faculty parameter.

No conclusive evidence could be found on effects, of the scale of operation on university costs.

Several models were tested relating the number of technical staff to numbers of academic staff, and to numbers of undergraduate and post-graduate students. The most satisfactory model arrived at explained technical as a constant factor multiplied by the number of academic staff in the faculty which again was multiplied by a parameter taking care of the country effect. The size of the country parameters varied substantial from country to country.

Methodology for Determination of Departmental Requirements.

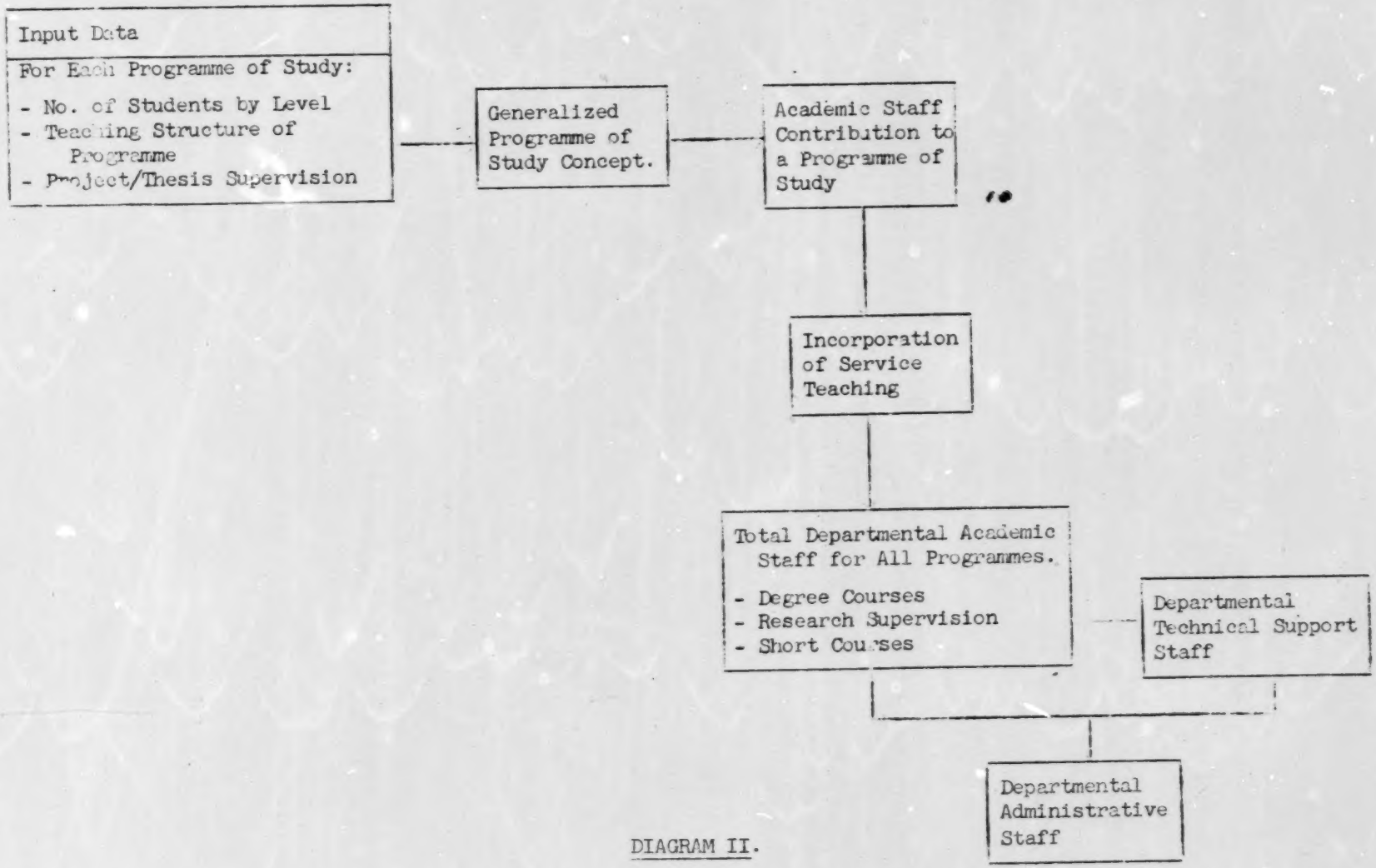

Input Data
For Each Programme of Study:
- No. of Students by Level
- Teaching Structure of Programme
- Project/Thesis Supervision
Generalized Programme of Study Concept.
Academic Staff Contribution to a Programme of Study
Incorporation of Service Teaching
Total Departmental Academic Staff for All Programmes.
- Degree Courses
- Research Supervision
- Short Courses
Departmental Technical Support Staff
Departmental Administrative Staff

DIAGRAM II.

3. The third study analyses 32 different types of university departments by grouping them into six major subject fields and five regions.

Large differences are observed in the number of students per academic staff member for, on the one hand, departments within, Pure Sciences, Technology and Medical Sciences and on the other hand, departments within, Humanities, Law and Social Sciences. Their differences are caused by differences in the teaching and research programmes carried out.

The number of staff needed to teach a given number of students on a particular level is governed by two factors, the number of teaching hours received by the students and the number of students a particular staff member can teach. The latter factor is again governed by two factors, the number of classes that a faculty member offers (teaching load) and the number of students in attendance that class (class size). It was found that differences in the total number of teaching hours provided per week was the most important reason for the differences observed in student/staff ratio.

A study of the distribution of academic staff on three levels according to rank (professional level, middle level and junior level) for selected university shows that faculties of Pure Sciences, Technology and Medical Sciences have a small proportion of the total academic staff in the professional rank and a higher proportion in the junior ranks than faculties of Law, Theology and Social Sciences.

An important factor causing the differences in staff structure is that different subject fields have experienced different rates of growth in the student numbers combined with the fact that the supply for new teachers has been mainly in the junior or middle ranks. Fields with a strong increase in student numbers will therefore tend to have a higher proportion of the total staff in the lower ranks than fields experiencing a lower growth in student enrolment, other things being equal. Add to this the fact that research effort is different in different fields. Thus, a part of the lower ranked academic staff reported by departments within Pure Sciences, Technology and Medical Sciences are research assistants or fellows having little if any teaching responsibilities.

Of the three factors discussed above, the seminar group size is the one that differs most between first degree and higher degree students. The total number of teaching hours scheduled for higher degree students is for all fields lower than for first degree students, on the average around 25% lower, and the part given as seminars not significantly different for the two levels (apart from Pure Sciences). But the average seminar group size is only half of the group size for first degree students. The lecture groups are small for higher degree students. Data suggests that they are of the same magnitude as the size of seminar groups for first degree students.

Thus, the differences in group size seem to be the most important reason for the differences in costs between students at the two levels.

Correlations coefficients calculated suggest strong correlations between academic and administrative staff than between administrative staff and students enrolled. This suggests that when determining the future need for administrative staff, the growth in the academic staff may be a better basis than the growth in the student enrolment numbers.

Economies of Scale

Although it is not usual among university teachers to regard their work in terms more commonly applied to industrial production, there are certain features of university teaching that might produce economies of scale. The work of preparing for two parallel classes in the same subject is, for instance, generally less than twice the work of preparing for only one class. To deliver a lecture to five hundred students hardly takes more time than if the audience numbers fifty. The extent to which such economies of scale are possible depends on the proportion of teaching given as lectures seminars, where the opportunities for economies of scale are smaller. This proportion varies according to subject field. One would therefore *a priori* assume that the possibilities for scale effects was higher for Law, Humanities and Social Sciences than for Pure Sciences, Technology and Medical Sciences where a greater proportion of the total teaching is given as seminars. But the data analysis did not reveal any significant scale economies.

One reason is probably that large departments tend to provide a more diversified programme than small departments. It is the number of classes offered and not primarily the number of students that determines the basic need for academic staff. And if the number of classes offered increases with the student enrolment, then the gain will go to support a more diversified programme instead of to lower the average costs in terms of academic staff use. The data refers to individual departments; possibilities for economies regarding the use of administrative and technical staff for central services is a different matter.

V. Reflections

It is difficult to reflect on one's own effort and that of one's collaborators when sufficient time has not yet elapsed to introduce at least a small degree of objectivity. This report therefore should have been written some time in the future when the work described here had had a chance for an impact. Also, the report should have been written by someone not so personally committed as the authors to the direction of the effort. Nevertheless, convention and expediency have required the preparation and submission of a synthetic view of the programme as a whole and to reflect on the achievements and failures over the last two years.

Models worked out in the context of private business enterprise could not be directly transplanted into a university environment. New and practical approaches had to be devised so as to be of greater relevance for tackling the special problems of university management.

These approaches now need to be tested in terms of, what Vice Chancellor Edward has called, their validity, their communicability and the extent to which positive incentives can encourage their use. Success of the first kind of test will depend upon the scientific merits of the work. The success of the second kind of test will depend upon a high degree of mutual trust between the experts and the executives of the university. The success of the final test is the responsibility of the university administrators who may sometimes rightly adhere to methods evolved through traditional wisdom and long experience.

Let us now return to the well-known, but nevertheless challenging, problems facing universities that were stated at the very outset. To what extent have the various facets of the programme come to grips with at least some of those issues.

The first issue raised was concerned with the manageability of the modern university. The Copenhagen team has proposed comprehensive long and medium term planning with the special feature of decentralized decision-making. So far little attention has been given to systematic thinking either on perspective planning treating universities as a component of the total higher education sector as well as to the necessity of decentralized decision-making at, and within, the university levels.

The problem of the wide array of functions and their management has centered on the mutual interactions between the education and the research processes of which we still know so little. The Nijmegen team has initiated work in this direction and claim that systems theory may offer us a line of attack.

The multiplicity of values, goals, objectives, preferences, emerge from the work started at Nanterre. Here the preferences of students, professors and the industry will be confronted with each other in order to search for a convergence. Even though this experiment is confined to a single department in a single university the implications may be quite far-reaching both in the case of developing new academic plans and in their continuious renovation.

The second issue posed at the outset was concerned with information requirements for making intelligent managerial decisions within universities. The Berlin team has launched work under the stress and strain or socio-political conflicts within and out side the university. But the experience in making the decision-making process transparent would be extremely useful if we wish to democratize the governance of universities. Furthermore, the Bradford team has boldly claimed the possibilities of substantially decreasing unit costs in British universities which the trend watchers have claimed not to be possible, because higher education appears to be subject to the principle of constant returns to scale. The explosive nature of this information can not be underestimated.

These are only a few selected observations that emerge from an impressionistic picture of the effort given in this report. We have used broad brush strokes to emphasize only a few aspects of the totality. Sometimes the details have been fitted in and at other times the picture has been left blurred. The responsibility for the report is with those that have prepared it and they may not have done justice to all the elements of the programme. But we hope that those receiving this report would have got the general flavour of the work which has only started and has a long way to go before a verdict can be passed.

It will be presumptuous to claim that the major issues of university management raised before can be solved in the foreseeable future. The justification for a research collaboration among universities and its continuation into the future on a wider scale must rest on important but less tangible reasons. The first reason is the opportunity that such a programme offers to universities to carry out a self-scrutiny drawing upon wider experience than that offered by using their own resources. Secondly, latent problems of management can be discussed explicitly within and among university communities in the sense of a continuing dialogue on issues and problems. Finally, the demonstration and diffusion of promising techniques can be carried out efficiently if a clearing house facility is made available to which a large number of universities have access.